

## Claims

1. A method for isolating and purifying a nucleic acid, comprising the step of:

(1) contacting a sample solution containing nucleic acid to a solid phase to adsorb the nucleic acid onto the solid phase;

(2) contacting a washing solution to the solid phase to wash the solid phase in such a state that the nucleic acid is adsorbed; and

(3) contacting an elution solution to the solid phase to desorb the nucleic acid,

wherein the sample solution containing nucleic acid contains an antifoaming agent.

2. The method for isolating and purifying a nucleic acid according to claim 1, wherein the sample solution containing nucleic acid is prepared by further addition and mixing of a pretreatment solution containing at least one selected from the group consisting of a nucleic acid stabilizer, a chaotropic salt, a surface-active agent, buffer and a protease.

3. The method for isolating and purifying a nucleic acid according to claim 1 or 2, wherein the sample solution

containing nucleic acid is prepared by further addition of a water-soluble organic solvent.

4. The method for isolating and purifying a nucleic acid according to any of claims 1 to 3, wherein the antifoaming agent contains at least one of a silicon type antifoaming agent and an alcohol type antifoaming agent.

5. The method for isolating and purifying a nucleic acid according to claim 2, wherein the pretreatment solution contains the nucleic acid stabilizer in a concentration of 0.1 to 20% by mass.

6. The method for isolating and purifying a nucleic acid according to claim 2, wherein the nucleic acid stabilizer is a reducing agent.

7. The method for isolating and purifying a nucleic acid according to claim 6, wherein the reducing agent is a mercapto compound.

8. The method for isolating and purifying a nucleic acid according to claim 2, wherein the nucleic acid stabilizer is a chelating agent.

9. The method for isolating and purifying a nucleic acid according to claim 2, wherein the chaotropic agent is a guanidium salt.

10. The method for isolating and purifying a nucleic acid according to claim 3, wherein the water-soluble organic solvent contains at least one selected from the group consisting of methanol, ethanol, propanol and butanol.

11. The method for isolating and purifying a nucleic acid according to any of claims 1 to 10, wherein the solid phase is a solid phase containing silica or a derivative thereof, diatomaceous earth or alumina.

12. The method for isolating and purifying a nucleic acid according to any of claims 1 to 10, wherein the solid phase is a solid phase containing an organic macromolecule.

13. The method for isolating and purifying a nucleic acid according to claim 12, wherein the organic macromolecule is an organic macromolecule having a polysaccharide structure.

14. The method for isolating and purifying a nucleic acid according to claim 12 or 13, wherein the organic macromolecule is acetylcellulose.

15. The method for isolating and purifying a nucleic acid according to claim 12 or 13, wherein the organic macromolecule is an organic macromolecule where acetylcellulose or a mixture of acetylcelluloses having different acetyl values is subjected to a saponification treatment.

16. The method for isolating and purifying a nucleic acid according to claim 15, wherein degree of saponification of the organic macromolecule prepared by a saponification treatment of the mixture of acetylcelluloses having different acetyl values is 5% or more.

17. The method for isolating and purifying a nucleic acid according to claim 15, wherein degree of saponification of the organic macromolecule prepared by a saponification treatment of the mixture of acetylcelluloses having different acetyl values is 10% or more.

18. The method for isolating and purifying a nucleic acid according to claim 12, wherein the organic macromolecule is a regenerated cellulose.

19. The method according to any of claims 11 to 18, wherein the solid phase is a porous membrane.

20. The method according to claim 19, wherein the porous membrane is a porous membrane, in which the front and back sides are asymmetric.

21. The method according to claim 19 or 20, wherein the porous membrane is a porous membrane having an average pore diameter of 0.1 to 10.0  $\mu\text{m}$ .

22. The method according to any of claims 19 to 21, wherein the porous membrane is a porous membrane having a thickness of 10 to 500  $\mu\text{m}$ .

23. The method according to any of claims 11 to 18, wherein the solid phase is nonporous.

24. The method according to any of claims 11 to 23, wherein the solid phase is coated beads.

25. The method according to claim 24, wherein the beads are magnetic beads.

26. The method for isolating and purifying a nucleic acid according to any of claims 1 to 25, wherein the adsorption and desorption of nucleic acid are carried out using a cartridge for isolating and purifying a nucleic acid, which houses the solid phase in a container having at least two openings.

27. The method for isolating and purifying a nucleic acid according to any of claims 1 to 26, wherein the adsorption and desorption of nucleic acid are carried out using a unit for isolating and purifying a nucleic acid, which has:

- (a) the solid phase;
- (b) a container having at least two openings, which houses the solid phase; and
- (c) an apparatus for generating the pressure difference, which is connected to one of the openings of the container.

28. The method for isolating and purifying a nucleic acid according to claim 27, wherein the apparatus for generating the pressure difference is an apparatus for

pressurization.

29. The method for isolating and purifying a nucleic acid according to claim 27, wherein the apparatus for generating the pressure difference is an apparatus for pressure reduction.

30. The method for isolating and purifying a nucleic acid according to any of claims 27 to 29, wherein the apparatus for generating the pressure difference is connected to one of the openings of the container in a freely detachable manner.

31. The method for isolating and purifying a nucleic acid according to claim 27 or 28, which comprises the step of:

(2a) preparing a sample solution containing nucleic acid from a sample and infusing the sample solution containing nucleic acid into one of the openings of the container housing the solid phase, the container having at least two openings;

(2b) making the inner area of the container into a pressurized state by using the apparatus for generating the pressure difference being connected to the one of the openings of the container and contacting the infused

sample solution containing nucleic acid to the solid phase by discharging the sample solution from another opening of the container to adsorb nucleic acid onto the solid phase;

(2c) detaching the apparatus for generating the pressure difference from the one opening of the container and infusing a washing solution into the one opening of the container;

(2d) making the inner area of the container into a pressurized state by using the apparatus for generating the pressure difference being connected to one of the openings of the container and discharging the infused washing solution from another opening of the container to contact the washing solution to the solid phase to wash the solid phase;

(2e) detaching the apparatus for generating the pressure difference from the one opening of the container and infusing an elution solution into the one opening of the container; and

(2f) making the inner area of the container into a pressurized state by using the apparatus for generating the pressure difference being connected to the one of the openings of the container and discharging the infused elution solution from another opening of the container to desorb the adsorbed nucleic acid from the solid phase

and discharge nucleic acid outside the container.

32. The method for isolating and purifying a nucleic acid according to claim 31, which comprises, before the step of (2e), (2d') contacting a solution of DNase to the solid phase and then washing the solid phase with the washing solution.

33. The method for isolating and purifying a nucleic acid according to any of claims 1 to 32, wherein the washing solution is a solution containing 20 to 100% by mass of methanol, ethanol, isopropanol or n-propanol.

34. The method for isolating and purifying a nucleic acid according to any of claims 1 to 33, wherein the elution solution is a solution having a salt concentration of not more than 0.5 mol/L.

35. A reagent kit for carrying out the method described in any of claims 1 to 34.

36. An apparatus for carrying out the method described in any of claims 1 to 34.